

STIC Database Tracking Number: 313023

To: HOANG-QUAN HO
Location: JEF-6C83
Art Unit: 2818
Tuesday, November 03, 2009

Case Serial Number: 10/517750

From: RAJ PATEL
Location: EIC2800
JEF-4A58
Phone: (571)272-6231

raj.patel@uspto.gov

Search Notes

RE: Organic FET having a plastic substrate that is biaxially stretched having an organic layer on top of that substrate

Examiner Ho,

Attached are the search history and the edited search results from the following databases:

- DIALOG – Multiple Files from the Engineering databases
- STN – HCAPLUS, WPIX, JAPIO & KOREAPAT

I recommend that you review the first few references; however I suggest that you browse through all of the enclosed documents.

Please feel free to let us know if you want us to perform more searching or have any questions or comments about this case.

Best Regards,
Raj.
Ext 2-6231

Sources

Jackson, Diane

NOV 2 2009

313023

From: Jackson, Diane
Sent: Monday, November 02, 2009 8:11 AM
To: STIC-EIC2800
Subject: FW: Confirmation Receipt: 2800 Search Request - 10517750

Requester -----

Name: HO, HOANG-QUAN
Organization: **GROUP ART UNIT 2818 (P/2818)**
Art Unit: **2818**
Employee Number: **81339**
Office Location: **JEF 6C83**
Phone Number: **(571)272-8711**
Email: hoangquan.ho@uspto.gov

Request Detail -----

Attachment: No

Case/Application number: **10517750** PALM
Priority App. Filing Date: 6/12/02
Format for Search Results: **EMAIL**
Board of Appeals Case?: No

Describe this invention in your own words.:
An organic, plastic thin film transistor.

Synonyms:

OFET (organic field effect transistor), TFT (thin film transistor) biaxially stretched, biaxial, well-ordered

Additional Comments:

I need reference(s) that discloses something about an organic, plastic substrate that is biaxially stretched used in a transistor. Ordinary, silicon is used as the substrate.

Request Date: **Sunday, November 1, 2009 8:11 PM**

*Substrate of polymer or plastic
bi-axial oriented
organic layer on top*

11/2/2009

Search

History

To

Follow

This

Sheet

? b 2,23,6,8,35,65,99,144,103,31,95,68,60,293,239,256,34,434

03nov09 11:11:51 Session D66.1

SYSTEM:OS - DIALOG OneSearch

File 2:INSPEC 1898-2009/Oct W4
(c) 2009 The IET

File 23:CSA Technology Research Database 1963-2009/Oct
(c) 2009 CSA.

File 6:NTIS 1964-2009/Nov W2
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File 144:Pascal 1973-2009/Nov W1
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File 103:Energy SciTec 1974-2009/Oct B1
(c) 2009 Contains copyrighted material

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File 95:TEME-Technology & Management 1989-2009/Oct W1
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File 60:ANTE: Abstracts in New Tech & Engineer 1966-2009/Oct
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File 293:Engineered Materials Abstracts 1966-2009/Oct
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File 239:Mathsci 1940-2009/Nov
(c) 2009 American Mathematical Society

File 256:TecTrends 1982-2009/Nov W1
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File 34:SciSearch(R) Cited Ref Sci 1990-2009/Oct W4
(c) 2009 The Thomson Corp

File 434:SciSearch(R) Cited Ref Sci 1974-1989/Dec
(c) 2006 The Thomson Corp

? ds

Set	Items	Description
S1	1119479	(OFET?? OR O()F()E()T OR ORGANIC(3N)TRANSISTOR?? OR TFT?? OR T()F()T OR THIN(3N)TRANSISTOR?? OR TRANSISTOR??? OR FET?? OR F()E()T OR OTFT?? OR O()T()F()T)
S2	10322	((BIAXIAL??? OR BI()AXIAL????) (2N) (STRETCH???? OR ORIENT????) OR BIAXIAL???? OR WELL(2N)ORDERED OR ISOTACTIC()POLYPROPYLENE?? OR POLYAMIDE?? OR POLYETHYLENE?? OR POLYETHYLENE()TEREPHTHALATE?? OR POLYPROPYLENE) (5N) ((PLASTIC OR POLYMER??) (2N) (SUBSTRATE?? OR FILM?? OR SURFACE))

S3	163648	ORGANIC(2N) (LAYER?? OR FILM?? OR COAT???? OR SHEET?? OR COVER???? OR DEPOSIT??? OR LAMINA?????)
S4	103979	((BIAXIAL??? OR BI()AXIAL????) (2N) (STRETCH???? OR ORIENT????) OR BIAXIAL???? OR WELL(2N)ORDERED)
S5	354617	((PLASTIC OR POLYMER??) (2N) (SUBSTRATE?? OR FILM?? OR SURFACE))
S6	0	S1 AND S2 AND S3 AND S4 AND S5
S7	13	S1 AND S2 AND S3
S8	10	RD (unique items)
S9	1	S8 NOT PY>2002
S10	18	S1 AND S3 AND S4 AND S5
S11	10	RD (unique items)
S12	10	S11 NOT S7
S13	4	S12 NOT PY>2002
S14	2	S1 AND S4(5N)S5
S15	2	RD (unique items)
S16	2	S15 NOT (S7 OR S10)
S17	0	S16 NOT PY>2002
S18	7	S3 AND S4(5N)S5
S19	7	RD (unique items)
S20	7	S19 NOT (S7 OR S10 OR S14)
S21	5	S20 NOT PY>2002
S22	287	S2 AND S3
S23	8	S22 AND S4
S24	8	RD (unique items)
S25	1	S24 NOT (S7 OR S10 OR S14 OR S18)
S26	1	S25 NOT PY>2002
S27	28	S22 AND ORGANIC(2N)LAYER????
S28	18	RD (unique items)
S29	16	S28 NOT (S7 OR S10 OR S14 OR S18 OR S23)
S30	7	S29 NOT PY>2002

STN 11/03/2009

Case# 10/517,750

FILE 'HCAPLUS, WPIX, JAPIO, KOREAPAT' ENTERED AT 10:03:15 ON 03 NOV 2009

L1 918338 SEA PLU=ON (OFET## OR O(W)F(W)E(W)T OR ORGANIC(3N)TRANSISTOR##
OR TFT## OR T(W)F(W)T OR THIN(3N)TRANSISTOR## OR TRANSISTOR##
OR FET## OR F(W)E(W)T OR OTFT## OR O(W)T(W)F(W)T)
L2 1350320 SEA PLU=ON ((BIAXIAL### OR BI(W) AXIAL####) (2N) (STRETCH####
OR ORIENT####) OR BIAXIAL#### OR WELL(2N) ORDERED OR ISOTACTIC(
W) POLYPROPYLENE## OR POLYAMIDE## OR POLYETHYLENE## OR
POLYETHYLENE(W) TEREPHTHALATE## OR POLYPROPYLENE)
L3 404189 SEA PLU=ON ((PLASTIC OR POLYMER##) (2N) (SUBSTRATE## OR FILM##
OR SURFACE))
L4 137561 SEA PLU=ON ORGANIC(2N) (LAYER## OR FILM## OR COAT#### OR
SHEET## OR COVER#### OR DEPOSIT## OR LAMINA####)
L5 136 SEA PLU=ON L1 AND L2 AND L3 AND L4
L6 10 SEA PLU=ON L5 NOT 2003-2009/PY, PRY
D L6 BIB AB KWIC 1-10

FILE 'STNGUIDE' ENTERED AT 10:08:09 ON 03 NOV 2009

FILE 'HCAPLUS, WPIX, JAPIO, KOREAPAT' ENTERED AT 10:35:33 ON 03 NOV 2009

L7 76838 SEA PLU=ON ((BIAXIAL### OR BI(W) AXIAL####) (2N) (STRETCH####
OR ORIENT####) OR BIAXIAL#### OR WELL(2N) ORDERED)
L8 4 SEA PLU=ON L1 AND L7 (5N) L3 AND L4
L9 0 SEA PLU=ON L8 NOT 2003-2009/PY, PRY
L10 12 SEA PLU=ON L1 AND L7 AND L3 AND L4
L11 3 SEA PLU=ON L10 NOT 2003-2009/PY, PRY
L12 0 SEA PLU=ON L11 NOT (L5 OR L8)
D L11 BIB AB KWIC 1-3

FILE 'STNGUIDE' ENTERED AT 10:40:37 ON 03 NOV 2009

FILE 'HCAPLUS, WPIX, JAPIO, KOREAPAT' ENTERED AT 10:43:30 ON 03 NOV 2009

L13 11 SEA PLU=ON L1 AND L7 AND ORGANIC(2N) LAYER####
L14 0 SEA PLU=ON L11 NOT (L5 OR L8 OR L10)
L15 202 SEA PLU=ON L7 AND ORGANIC(2N) LAYER####
L16 59 SEA PLU=ON L15 AND L3
L17 53 SEA PLU=ON L16 NOT (L5 OR L8 OR L10 OR L13)
L18 23 SEA PLU=ON L17 NOT 2003-2009/PY, PRY
D BIB AB 1-23

FILE 'STNGUIDE' ENTERED AT 10:49:04 ON 03 NOV 2009

FILE 'HCAPLUS, WPIX, JAPIO, KOREAPAT' ENTERED AT 10:51:58 ON 03 NOV 2009

D L18 BIB AB KWIC 1-23

Search

Results

To

Follow

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Sheet

L6 ANSWER 1 OF 10 HCAPLUS COPYRIGHT 2009 ACS on STN

AN 2002:92432 HCAPLUS

DN 136:393159

TI Organic thin-film transistor

-driven polymer-dispersed liquid crystal displays on flexible
polymeric substrates

AU Sheraw, C. D.; Zhou, L.; Huang, J. R.; Gundlach, D. J.; Jackson, T. N.;
Kane, M. G.; Hill, I. G.; Hammond, M. S.; Campi, J.; Greening, B. K.;
Francl, J.; West, J.

CS Center for Thin Film Devices, and Electronic Materials and Processing
Research Laboratory, Department of Electrical Engineering, The
Pennsylvania State University, University Park, PA, 16801, USA

SO Applied Physics Letters (2002), 80(6), 1088-1090

CODEN: APPLAB; ISSN: 0003-6951

PB American Institute of Physics

DT Journal

LA English

AB The authors have fabricated organic thin-film transistor

(OTFT)-driven active matrix liquid crystal displays on flexible
polymeric substrates. These small displays have

16+16 pixel polymer-dispersed liquid crystal arrays addressed by
pentacene active layer OTFT. The displays were fabricated using
a low-temperature process (<110°) on flexible polyethylene

naphthalate film and are operated as reflective active matrix displays.

Organic thin-film transistor-driven polymer-dispersed liquid crystal displays on flexible polymeric substrates

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M. G. Kane, I. G. Hill, M. S. Hammond, J. Campi, and B. K. Greening

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(Received 24 July 2001; accepted for publication 5 December 2001)

We have fabricated organic thin-film transistor (OTFT)-driven active matrix liquid crystal displays on flexible polymeric substrates. These small displays have 16×16 pixel polymer-dispersed liquid crystal arrays addressed by pentacene active layer OTFTs. The displays were fabricated using a low-temperature process ($<110^\circ\text{C}$) on flexible polyethylene naphthalate film and are operated as reflective active matrix displays. © 2002 American Institute of Physics.

[DOI: 10.1063/1.1448659]

Organic thin-film transistors (OTFTs) have received considerable attention recently because they can be fabricated at reduced temperature and potentially reduced cost compared to hydrogenated amorphous silicon thin-film transistors. Low fabrication temperature allows a wide range of substrate possibilities and makes OTFTs an attractive technology for many low-cost electronics applications, particularly those that require or may benefit from flexible polymeric substrates such as rf identification tags, smart cards, electronic paper, and flat panel displays. In the case of flat panel displays, the integration of OTFTs on polymeric substrates with liquid crystal materials or organic light emitters allows active matrix liquid crystal displays (AMLCDs) or active matrix organic light emitting diode displays that are flexible, lightweight, inexpensive, and rugged.

OTFT technology continues to advance, with recent reports of organic integrated circuits on rigid^{1,2} and polymeric substrates,^{3,4} organic "smart pixels" which combine OTFTs with organic light emitting devices,⁵⁻⁷ a 64×64 pixel AM-LCD display driven by polymer transistors on a glass substrate,⁸ and a 2×3 pixel AMLCD display using OTFTs on a polymeric substrate.⁹ Here we report 16×16 pixel OTFT-based AMLCDs fabricated on flexible polymeric substrates.

OTFTs with a pentacene active layer were used to fabricate 4×4 mm pixel array backplanes on polymeric film with a maximum device processing temperature of only 110°C . The maximum temperature is limited by a photore-sist softbake during photolithographic patterning of metal and dielectric layers. Polymer-dispersed liquid crystal (PDLC) was used as the electro-optic element to make active matrix reflective displays. The PDLC is transparent when the liquid crystal domains are aligned by an applied electric field controlled by the OTFTs. In the absence of an electric field,

light is scattered by the nonaligned liquid crystal domains. Polymer-dispersed liquid crystals were chosen for their compatibility with flexible displays since they are not based on polarization and provide wide viewing angle while avoiding problems with polymer substrate birefringence.

The substrate material was $125\ \mu\text{m}$ thick transparent polyethylene naphthalate (PEN) film. Prior to device processing, the substrates were mounted to glass carriers for mechanical support using vacuum lamination and heated to 150°C for 2 h to reduce substrate shrinkage during subsequent processing. The polymeric film was held to the glass carriers using a pressure sensitive silicone gel, which allows the glass support to be easily removed after processing. Nickel gate electrodes, silicon dioxide gate dielectric, transparent indium tin oxide (ITO) pixel electrodes, and palladium source and drain contacts were deposited by ion-beam sputtering and patterned using photolithography and liftoff. The pentacene active layer was deposited by thermal evaporation at a rate of $\sim 0.5\ \text{\AA/s}$ with the display substrate held at 60°C . Prior to active layer deposition, the gate dielectric surface was vapor treated using octyldecyltrichlorosilane at 100°C .

Our pentacene thin-film transistors (TFTs) are typically slightly depletion mode and have significant off-state leakage through the pentacene layer. This leakage greatly reduces on/off current ratio, an important device parameter for active matrix displays, and can be eliminated by patterning the pentacene active layer. To pattern the active layer without significantly degrading the pentacene, water-based polyvinyl alcohol (PVA) photosensitized with ammonium dichromate was used. The PVA is applied by spin coating and photolithographically patterned to form an etch mask. The pentacene layer outside the active device regions is then removed with an oxygen plasma.

Figure 1 shows electrical characteristics for a typical pentacene TFT on PEN film with channel width of $200\ \mu\text{m}$, channel length of $10\ \mu\text{m}$, and oxide thickness of $450\ \text{nm}$.

^{a)}Electronic mail: cxs263@psu.edu

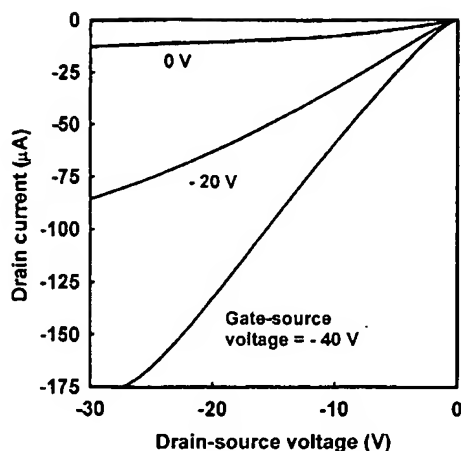


FIG. 1. Drain current as a function of drain-source voltage for a discrete pentacene TFT on flexible PEN film with $L = 10 \mu\text{m}$, $W = 200 \mu\text{m}$, and gate oxide thickness of 450 nm.

This device has a saturation carrier field-effect mobility of $1.2 \text{ cm}^2/\text{Vs}$ and on/off current ratio of 10^8 . We found that direct exposure of pentacene to PDLC materials severely degrades TFT performance. To avoid this degradation, an additional layer of PVA was deposited as a protective barrier. Some pentacene TFT degradation was still observed after PDLC assembly; the cause of this degradation is still under investigation. OTFT on currents dropped by a factor of 3–8 \times after PDLC assembly, due to a reduction in mobility and shift in threshold voltage. Even with this degradation, device performance was sufficient to obtain functioning pixel arrays. The display was completed by depositing a 4:1 mixture of Merck TL205 liquid crystal and PN393 polymer precursor directly onto the passivated OTFT backplane and then laminating a Mylar[®] cover sheet onto the sample. The PDLC cell was then created from the mixture by photoinduced phase separation¹⁰ using illumination from an ultraviolet lamp ($10 \text{ mW}/\text{cm}^2$ intensity) for ~ 20 minutes. PDLC

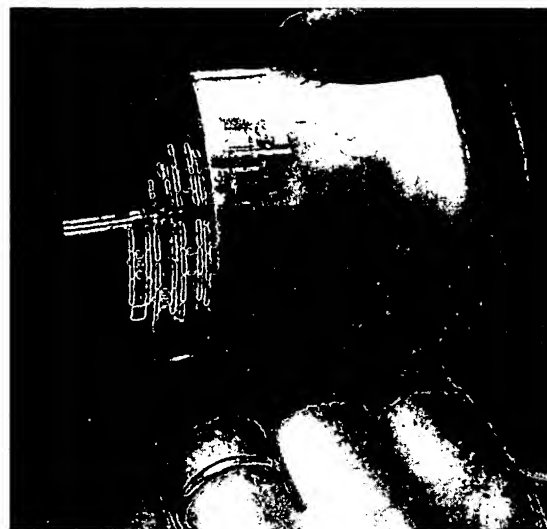


FIG. 3. Photograph of a test chip containing pentacene TFTs, circuits, and pixel arrays on flexible PEN film removed from glass carrier after PDLC assembly.

thickness was set by $16 \mu\text{m}$ plastic spacers. The Mylar[®] sheet was coated on one side with ITO to act as the common electrode for the display. Figure 2(a) shows a schematic cross section and Fig. 2(b) an optical micrograph of a single pentacene TFT pixel on PEN film. Figure 3 shows a photograph of a test chip containing pentacene TFTs, circuits, and pixel arrays on flexible PEN film removed from the glass carrier after PDLC assembly.

Four different types of $250 \mu\text{m}$ -pitch, 16×16 pixel arrays were fabricated with clear aperture between 38% and 58%, and varying OTFT design. All arrays showed reasonable electro-optic response to 1/4-VGA wave forms with the best performance for arrays with the largest OTFT width to length ratio. Each array was operated using data voltage $= \pm 20 \text{ V}$, select voltage $= -30 \text{ V}$, and deselect voltage $= +25 \text{ V}$ with $69 \mu\text{s}$ line time and 60 Hz refresh rate. Because of the PDLC-degradation-related reduced OTFT on currents, the pixels were not able to fully converge at the $\pm 20 \text{ V}$ data voltage in the $69 \mu\text{s}$ line time. However, even with degraded on currents and their resulting pixel convergence errors, the pixel arrays were able to respond well to

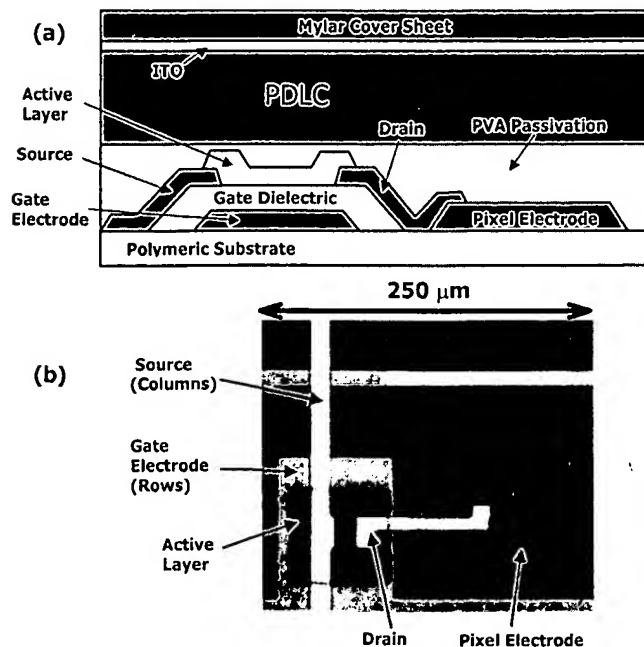


FIG. 2. (a) Schematic cross section and (b) optical micrograph of a single pentacene OTFT-AMLCD pixel on flexible PEN film.

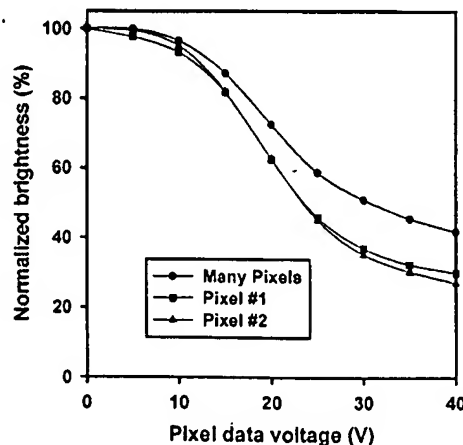


FIG. 4. Reflective electro-optic characteristics for a OTFT-AMLCD pixel array. Brightness as a function of pixel data voltage was measured over an area containing many pixels and for two individual pixels. Each curve is normalized to the brightness at a pixel data voltage of zero.

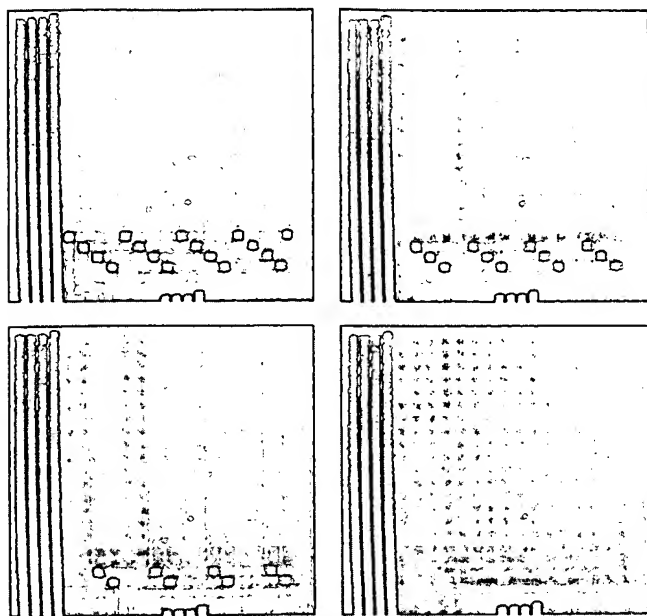


FIG. 5. Optical micrographs showing different patterns on a pentacene OTFT-driven 16×16 reflective active matrix PDLC display on flexible PEN film. Each array is 4 mm on a side.

changing data and gave good visual performance. Pixel yield was high ($\geq 98\%$) considering that the substrates were not fabricated in a clean room environment. Illumination conditions consisted of a standard incandescent lamp approximately 45° off axis with a black absorber placed behind the display. Figure 4 gives reflective electro-optic characteristics for a pixel array showing relative brightness as a function of pixel data voltage for three different cases. For the first case, brightness was measured by averaging the reflected light over a large area containing many pixels. In the other two cases, measurements were taken at the center of the pixel electrode for two individual pixels. Each curve is normalized to the brightness at a pixel data voltage of zero volts. The measured contrast ratio is relatively small ($>2:1$ for many pixels and $>3:1$ for single pixels) due to the reflection from

the metal lines and other areas outside the pixel electrode which is evident from the improved brightness curves and contrast ratio for the individual pixels. The contrast ratio could easily be improved by using a black matrix layer to reduce reflections outside the pixel electrode. Figure 5 shows optical micrographs of a functioning pixel array displaying four different patterns.

Active matrix PDLC displays driven by pentacene organic thin-film transistors on flexible polymeric substrates have been fabricated and show good response to 1/4-VGA waveforms. Our results confirm that flexible active matrix displays can be made on polymeric substrates using a low-temperature organic thin-film transistor process. These prototype pixel arrays demonstrate the usefulness of OTFTs for low-cost electronics and are a step toward the realization of cheap, light-weight, and flexible applications such as flat panel displays.

Financial support by the Defense Advanced Research Projects Agency and the Naval Surface Warfare Center—Dahlgren Division is gratefully acknowledged.

- ¹Y. Y. Lin, A. Dodabalapur, R. Sarpeshkar, Z. Bao, W. Li, K. Baldwin, V. R. Raju, and H. E. Katz, *Appl. Phys. Lett.* **74**, 2714 (1999).
- ²B. Cronc, A. Dodabalapur, Y. Lin, R. W. Filas, Z. Bao, A. LaDuca, R. Sarpeshkar, H. E. Katz, W. Li, *Nature (London)* **403**, 521 (2000).
- ³G. H. Gelinck, T. C. T. Geuns, and D. M. de Leeuw, *Appl. Phys. Lett.* **77**, 1487 (2000).
- ⁴M. G. Kane, J. Campi, F. P. Cuomo, B. Greening, C. D. Sheraw, J. A. Nichols, D. J. Gundlach, J. R. Huang, C. C. Kuo, L. Jia, H. Klauk, and T. N. Jackson, *IEEE Electron Device Lett.* **21**, 534 (2000).
- ⁵H. Sirringhaus, N. Tessler, and R. H. Friend, *Science* **280**, 1741 (1998).
- ⁶J. A. Rogers, Z. Bao, A. Dodabalapur, and A. Makhija, *IEEE Electron Device Lett.* **21**, 100 (2000).
- ⁷H. Klauk, B. D'Andrade, and T. N. Jackson, *57th Annual Device Research Conference Digest*, 1999, p. 162.
- ⁸"Philips Research develops the world's first display using polymeric semiconductors as pixel drivers," <http://www.research.philips.com/pressmedia/releases/000901a.html>, September 2000.
- ⁹P. Mach, S. J. Rodriguez, R. Nortrup, P. Wiltzius, and J. A. Rogers, *Appl. Phys. Lett.* **78**, 3592 (2001).
- ¹⁰P. Drzaic, *Liquid Crystal Dispersions* (World Scientific, Singapore, 1995).

L6 ANSWER 3 OF 10 HCAPLUS COPYRIGHT 2009 ACS on STN
AN 2000:482016 HCAPLUS
DN 133:170768
TI High-mobility, low voltage organic thin film
transistors
AU Gundlach, David J.; Klauk, Hagen; Sheraw, Chris D.; Kuo, Chung-Chen;
Huang, Jiunn-Ru; Jackson, Thomas N.
CS Center for Thin Film Devices, The Pennsylvania State University,
University Park, PA, 16801, USA
SO Technical Digest - International Electron Devices Meeting (1999) 111-114
CODEN: TDIMD5; ISSN: 0163-1918
PB Institute of Electrical and Electronics Engineers
DT Journal
LA English
AB We have fabricated photolithog. defined organic thin film
transistors (TFTs) on glass or plastic
substrates with carrier field-effect mobility $>1 \text{ cm}^2/\text{V-s}$, using
the organic semiconductor pentacene as the active layer. In addition to high
carrier mobility, devices on glass substrates have subthreshold slope as
low as 0.4 V/decade. TFT performance for devices on both
substrate types was extracted at low bias (less than -30 V). These results
are the best reported to date for organic TFTs on polymeric
and glass substrates.
IT 135-48-8, Pentacene
RL: DEV (Device component use); USES (Uses)
(fabrication of high-mobility, low-voltage pentacene thin
film transistors)
IT 25038-59-9, Polyethylene terephthalate, uses
RL: DEV (Device component use); USES (Uses)
(substrate; fabrication of high-mobility, low-voltage pentacene
thin film transistors on)

High-Mobility, Low Voltage Organic Thin Film Transistors

David J. Gundlach, Hagen Klauk, Chris D. Sheraw, Chung-Chen Kuo,
Jiunn-Ru Huang, and Thomas N. Jackson

Center for Thin Film Devices, and Electronic Materials and Processing Research Laboratory
The Pennsylvania State University, 121 Electrical Engineering East, University Park, PA 16801 U. S. A.
Tel.: 814-865-1267, fax: 814-865-2798, email: djg110@psu.edu

Abstract

We have fabricated photolithographically defined organic thin film transistors (TFTs) on glass or plastic substrates with carrier field-effect mobility larger than $1 \text{ cm}^2/\text{V-s}$, using the organic semiconductor pentacene as the active layer. In addition to high carrier mobility, devices on glass substrates have subthreshold slope as low as 0.4 V/decade . TFT performance for devices on both substrate types was extracted at low bias (less than -30 V). These results are the best reported to date for organic TFTs on polymeric and glass substrates.

Introduction

Thin film transistors (TFTs) using organic semiconductors as the active layer material have received considerable attention in recent years. The use of organic semiconductors as the active layer in TFTs may offer processing advantages over conventional thin film active layer materials like hydrogenated amorphous silicon (a-Si:H) including reduced processing temperature. This allows the use of inexpensive substrates of arbitrary size including glass or polymers. Potential applications for organic TFTs include pixel access devices in active matrix liquid crystal displays, integrated pixel devices in all-organic emissive displays, and low cost electronics for smart cards or merchandise tags (1-3).

Organic TFT performance has greatly improved over the last decade and has rapidly approached that of a-Si:H TFTs (4-7). While several organic active layer materials have been extensively investigated, to date organic TFTs fabricated using pentacene as the active layer material have shown the best performance (8-10). Pentacene, a short-chain molecule consisting of five linearly fused benzene rings, is typically used as a p-type semiconductor. Pentacene TFTs with carrier field-effect mobility as large as $2 \text{ cm}^2/\text{V-s}$ have been reported for TFTs fabricated on single-crystal silicon substrates (4), and pentacene TFT circuits fabricated on glass substrates have been reported with sub- $75\text{-}\mu\text{s}$ ring oscillators propagation delay (11). Pentacene TFTs have also been integrated with a-Si:H TFTs to form CMIS circuits with sub- $10\text{-}\mu\text{s}$ propagation delay (12,13). Pentacene TFTs have also

been demonstrated with subthreshold slope as low as 0.7 V/decade , near-zero threshold voltage, and on/off current ratio larger than 10^8 , making them suitable for display and other low-voltage applications (8,10).

Although performance similar to a-Si:H TFTs has been reported, early devices typically required large gate-source and drain-source bias to obtain large carrier field-effect mobility and on/off current ratio (5). Additionally, many of the reports of high-performance organic TFTs use simple test structures, not suitable for large area electronic applications. Much of the early work and also more recent results used oxidized single-crystal silicon substrates. Since photolithographic processing of organic active layer materials is problematic, such devices, including more recent devices on polymeric substrates, typically used source and drain contacts deposited through a shadow-mask either before or after the organic active layer deposition (14). In this work we have investigated photolithographically defined pentacene TFTs on glass or polymeric substrates with the goal of fabricating high-performance TFTs with low operating voltages on substrate materials suitable for large area electronic applications.

Device Fabrication

For this work we used polyethylene terephthalate (PET) film as the polymeric substrate material and borosilicate glass (Corning 7059) as the glass substrate material. All transistors were fabricated using the device structure shown in Fig. 1. Prior to device fabrication, the $50 \mu\text{m}$ thick PET was mounted to a $2'' \times 2''$ glass carrier with a $200 \mu\text{m}$ thick polyethylene adhesive layer for mechanical support, and preshrunk at 135°C for 1 hour. Nickel gate electrodes, a silicon dioxide gate dielectric layer, and palladium source and drain contacts were all deposited by ion-beam sputtering and patterned by photolithography and lift-off. To reduce mechanical stress the SiO_2 layer was deposited at a substrate temperature of 80°C . Although the electrical and mechanical properties of ion-beam deposited SiO_2 are somewhat inferior to those obtained for SiO_2 thermally grown on single-crystal silicon, they are adequate for fabricating organic TFTs (10,11).

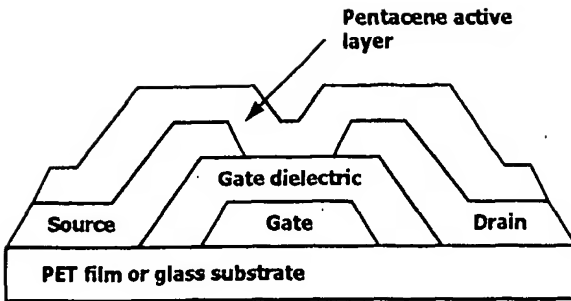


Fig. 1. Pentacene thin film transistor structure.

To obtain pentacene TFTs with large carrier field-effect mobility, small subthreshold slope, and low threshold voltage we find it is often beneficial to functionalize the surface of the gate dielectric layer using an organosilane (8). In this work, the organosilane octadecyltrichlorosilane (OTS) was used to treat the SiO_2 surface prior to pentacene deposition. Because the PET film and glass substrates have different chemical compatibilities, two different OTS treatment methods were used. Glass substrates were immersed in a 2% solution of OTS in hexadecane, while PET substrates were treated using a vacuum vapor-prime technique.

Pentacene was deposited by thermal evaporation onto substrates held at 60°C with a deposition rate near 0.5 \AA/s . Prior to the active-layer deposition, the pentacene was purified by temperature-gradient vacuum sublimation. Improved purity of the active layer material, moderate substrate heating, and low deposition rates have been shown to improve TFT performance (9,15). Fig. 2 and Fig. 3 show photographs of the completed devices on PET film and glass. In the PET sample photograph of Fig. 3 the circular area corresponds to the exposure area of the photolithography tool.

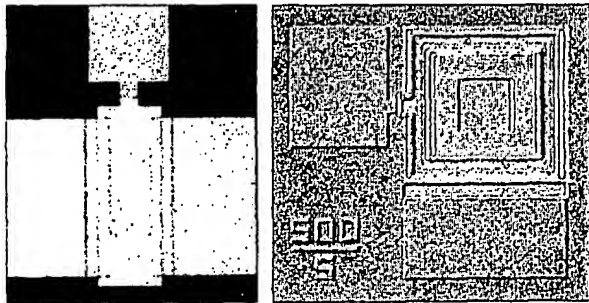


Fig. 2. Pentacene thin film transistors on PET film (left) and on glass (right).

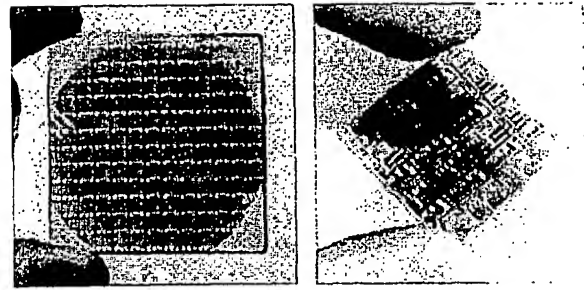


Fig. 3. Pentacene thin film transistors on laminated PET film mounted to a glass carrier for mechanical support during processing (left), and pentacene thin film transistors on glass (right).

Device Characteristics

All TFTs were characterized in a nitrogen ambient glove box using a HP4145B Semiconductor Parameter Analyzer. Fig. 4 and Fig. 5 show the electrical characteristics of an OTS-treated pentacene TFT on PET film. From the $\sqrt{I_D}$ - V_{GS} characteristics in Fig. 5 for the region where the TFT is biased in saturation, a carrier field-effect mobility of $1.1 \text{ cm}^2/\text{V}\cdot\text{s}$ and a threshold voltage of -2 V is extracted. For these devices with patterned gate electrodes, the on/off current ratio is limited by leakage through the pentacene layer in the un-gated regions since no active-layer isolation was used. With active-layer isolation the on/off current ratio can be increased by several orders of magnitude (10).

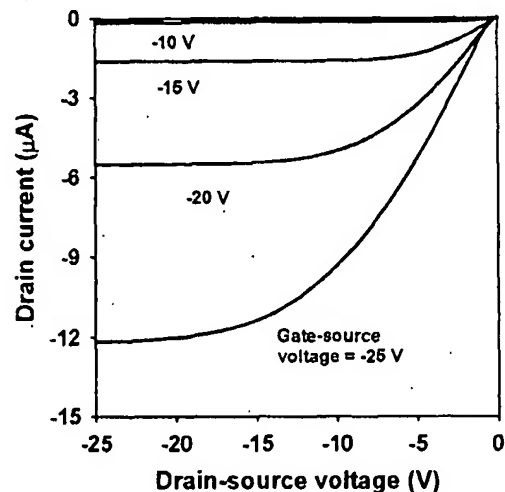


Fig. 4. I_D - V_{DS} characteristics of a pentacene thin film transistor on PET film with carrier mobility of $1.1 \text{ cm}^2/\text{V}\cdot\text{s}$. The device has a gate width of $240 \text{ }\mu\text{m}$, gate length of $44 \text{ }\mu\text{m}$, and gate dielectric thickness of 1700 \AA .

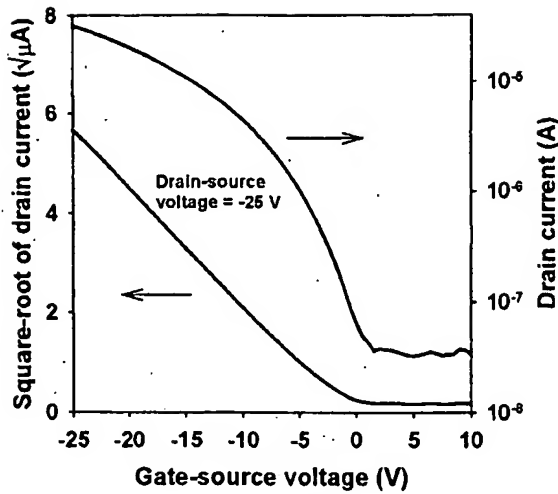


Fig. 5. $\sqrt{I_D}$ - V_{GS} and $\log I_D$ - V_{GS} characteristics of a pentacene thin film transistor on PET film with carrier mobility of $1.1 \text{ cm}^2/\text{V}\cdot\text{s}$, on/off current ratio near 10^3 , and threshold voltage of -2 V . The device has a gate width of $240 \mu\text{m}$, gate length of $44 \mu\text{m}$, and gate dielectric thickness of 1700 \AA .

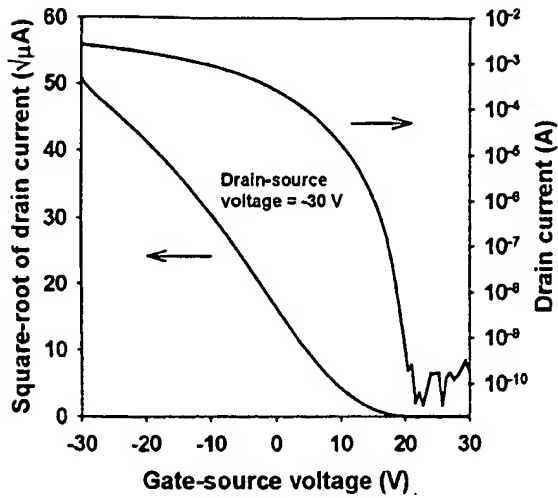


Fig. 7. $\sqrt{I_D}$ - V_{GS} and $\log I_D$ - V_{GS} characteristics of a pentacene thin film transistor on glass with carrier mobility of $1.7 \text{ cm}^2/\text{V}\cdot\text{s}$, subthreshold slope of 0.9 V/decade , on/off current ratio near 10^8 , and threshold voltage of 10 V . The device has a gate width of $500 \mu\text{m}$, gate length of $5 \mu\text{m}$, and gate dielectric thickness of 1400 \AA .

Fig. 6 and Fig. 7 show the electrical characteristics of an OTS-treated pentacene TFT on glass with a gate length of $5 \mu\text{m}$. The devices on glass substrates used a corbino structure for device isolation. At a drain-source voltage of -20 V and a gate-source voltage of -20 V , the device supplies a drain current of $2.5 \mu\text{A}$ per micron gate width. From the $\sqrt{I_D}$ vs. V_{GS} characteristics of the device, a field-effect mobility of $1.7 \text{ cm}^2/\text{V}\cdot\text{s}$ is extracted. The device has a threshold voltage of $+10 \text{ V}$, a subthreshold slope of 0.9 V/decade , and an on/off current ratio near 10^8 .

Fig. 8 and Fig. 9 show the electrical characteristics of an OTS-treated pentacene TFT on glass with a gate length of $30 \mu\text{m}$. The threshold voltage of this device is 2 V , and the subthreshold slope is 0.4 V/decade . At a drain-source voltage of only -10 V , the TFT has a carrier field-effect mobility of $0.6 \text{ cm}^2/\text{V}\cdot\text{s}$, and the on/off current ratio obtained when the gate is biased between -10 V and $+10 \text{ V}$ is 10^6 , limited by low-current measurement accuracy.

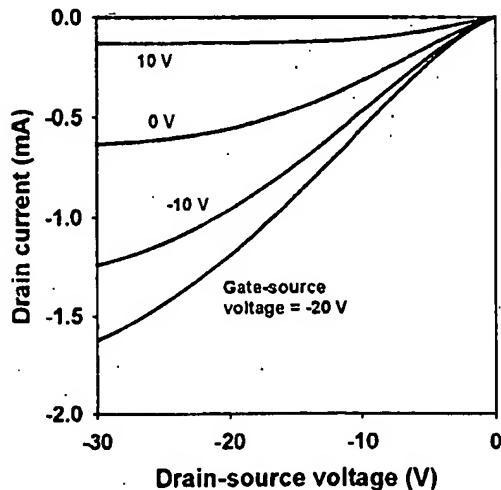


Fig. 6. I_D - V_{DS} characteristics of a pentacene thin film transistor on glass with carrier mobility of $1.7 \text{ cm}^2/\text{V}\cdot\text{s}$. The device has a gate width of $500 \mu\text{m}$, gate length of $5 \mu\text{m}$, and gate dielectric thickness of 1400 \AA .

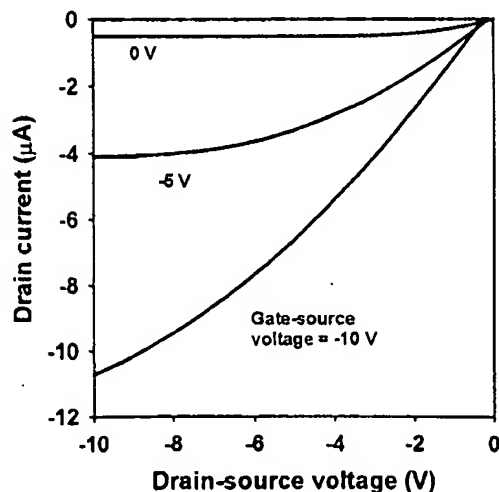


Fig. 8. I_D - V_{DS} characteristics of a pentacene thin film transistor on glass with carrier mobility of $0.6 \text{ cm}^2/\text{V}\cdot\text{s}$. The device has a gate width of $300 \mu\text{m}$, gate length of $30 \mu\text{m}$, and gate dielectric thickness of 1400 \AA .

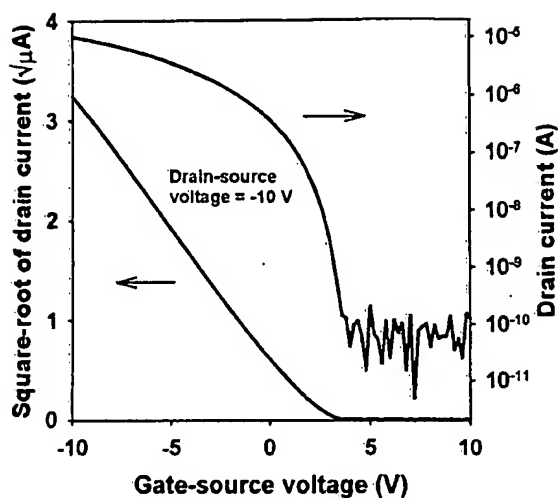


Fig. 9. $\sqrt{I_D}$ - V_{GS} and $\log I_D$ - V_{GS} characteristics of a pentacene thin film transistor on glass with carrier mobility of $0.6 \text{ cm}^2/\text{V}\cdot\text{s}$, subthreshold slope of 0.4 V/decade , on / off current ratio near 10^6 , and threshold voltage of 2 V . The device has a gate width of $300 \text{ }\mu\text{m}$, gate length of $30 \text{ }\mu\text{m}$, and gate dielectric thickness of $1400 \text{ }\text{\AA}$.

Summary

Pentacene TFTs with high carrier mobility operating at low voltages have been fabricated on a variety of substrate materials suitable for large area electronic applications. Devices on borosilicate glass showed the best performance with carrier field-effect mobility as large as $1.7 \text{ cm}^2/\text{V}\cdot\text{s}$, on/off current ratio as large as 10^8 , and subthreshold slope as low as 0.4 V/decade . Devices on PET had somewhat poorer performance with carrier field-effect mobility as large as $1.1 \text{ cm}^2/\text{V}\cdot\text{s}$. For devices on both substrate types electrical characteristics were extracted for operating voltages of -30 V or less. These results are the best reported to date for organic thin film transistors on polymeric and glass substrates.

Acknowledgements

This work was supported by Sarnoff, the Defense Advanced Research Projects Agency, and Opticom ASA.

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L18 ANSWER 3 OF 23 HCAPLUS COPYRIGHT 2009 ACS on STN

AN 1992:195880 HCAPLUS

DN 116:195880

OREF 116:33203a,33206a

TI Biaxially oriented films with layers
containing slippery organic core-shell particles

IN Sumiya, Takashi; Yamagishi, Hideki; Kuboyama, Hiroshi

PA Toray Industries, Inc., Japan

SO Jpn. Kokai Tokkyo Koho, 10 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 03297646	A	19911227	JP 1990-99874	19900416
	JP 2550747	B2	19961106		
PRAI	JP 1990-99874		19900416		

AB The title films with good adhesion and scratch resistance are prepared by forming layers containing organic core-shell particles with average diameter 0.002-8.0 μm , and water-soluble or water-dispersible resins on ≥ 1 side of biaxially oriented films. Thus, a longitudinally oriented PET film was coated with a dispersion containing 100 parts 1:1 Bu acrylate-Me acrylate copolymer and 4 parts particles with average diameter 0.1 μm comprising 1:9 Et methacrylate-Me methacrylate (I) copolymer core and 5:5 Bu methacrylate-I copolymer shell, dried, transversely oriented, and heat set to give a 50- μm film with a 0.05- μm coated layer having good slippery property and scratch resistance.

TI Biaxially oriented films with layers
containing slippery organic core-shell particles

AB . . . forming layers containing organic core-shell particles with average diameter 0.002-8.0 μm , and water-soluble or water-dispersible resins on ≥ 1 side of biaxially oriented films. Thus, a longitudinally oriented PET film was coated with a dispersion containing 100 parts 1:1 Bu acrylate-Me acrylate copolymer. . .

ST biaxially oriented coated PET film; polyacrylate
particle layer PET film; slippery org particle coated PET; scratch
resistance coated PET film; sliding improved multilayer plastic
film

IT Plastics, laminated

RL: USES (Uses)

(biaxially oriented films with organic core-shell
particle-containing layers, slippery and scratch-resistant)

L6 ANSWER 5 OF 10 WPIX COPYRIGHT 2009 THOMSON REUTERS on STN
AN 2000-675663 [66] WPIX
DNC C2000-205380 [66]
DNN N2000-500926 [66]
TI Thin film field effect transistor production for flat panel display, involves adhering organic semiconductor and inorganic oxide gate insulating layers on plastic substrate, by preset process at preset temperature
DC L03; U12
IN ALESSANDRO S K; CALLEGARI A C; DIMITRAKOPOULOS C D; PURUSHOTHAMAN S
PA (IBMC-C) IBM CORP; (IBMC-C) INT BUSINESS MACHINES CORP
CYC 2
PIA JP 2000269515 A 20000929 (200066)* JA 9[16]
US 6207472 B1 20010327 (200119) EN
US 20010015438 A1 20010823 (200151) EN
ADT JP 2000269515 A JP 2000-64964 20000309; US 6207472 B1 US 1999-265161 19990309; US 20010015438 A1 Div Ex US 1999-265161 19990309; US 20010015438 A1 US 2000-740721 20001218
FDT US 20010015438 A1 Div ex US 6207472 A
PRAI US 1999-265161 19990309
US 2000-740721 20001218
AB JP 2000269515 A UPAB: 20060117
NOVELTY - An organic semiconductor layer and an inorganic oxide gate insulating layer are adhered on a plastic substrate at 25 degreesC or 150 degreesC, by performing either sputtering process or spinning or metallizing or laser ablation. A gate electrode on which source and drain electrodes are adhered is formed on the semiconductor and gate insulating layers, on the substrate.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for thin film field effect transistor.
USE - For producing thin film field effect transistor for flat panel display.
DESCRIPTION OF DRAWINGS - The figure shows the components of TFT.
Member(0003)
ABEN UPAA 20060117
The invention broadens the range of materials and processes that are available for Thin Film Transistor (TFT) devices by providing in the device structure an organic semiconductor layer The invention broadens the range of materials and processes that are available for Thin Film Transistor (TFT) devices by providing in. . . processing at up to 150 degrees C.
A TFT of the invention has a pentacene semiconductor layer in contact with a barium zirconate titanate gate oxide layer formed on a polycarbonate transparent substrate employing atA TFT of the invention has a pentacene semiconductor layer in contact with a barium zirconate titanate gate oxide layer formed. .

L18 ANSWER 13 OF 23 WPIX COPYRIGHT 2009 THOMSON REUTERS on STN
AN 1993-356888 [45] WPIX
DNC C1993-158052 [45]
DNN N1993-275654 [45]
TI Laminated sheet for mould releasing - comprising an organic
polymer support layer and a polymer substrate
layer
DC A26; A94; L02; P73
IN KIDA K; MIYAJI S; UEDA T
PA (TORA-C) TORAY IND INC
CYC 1
PIA JP 05261868 A 19931012 (199345)* JA 7[0]
JP 3080259 B2 20000821 (200043) JA 7
ADT JP 05261868 A JP 1992-89359 19920316; JP 3080259 B2 JP 1992-89359 19920316
FDT JP 3080259 B2 Previous Publ JP 05261868 A
PRAI JP 1992-89359 19920316
AB JP 05261868 A UPAB: 20050510

The sheet comprises a support layer (B) made of an organic polymer
and a substrate layer (A) made of another organic
polymer film. The ratio (p/a) of adhesivity (p) g/cm
between the (A) layer and (B) layer and thickness (a) microns of the (A)
layer, is 0.3-8.

Pref. (A) is made of a compsn. comprising mainly polyphenylenesulphide. A
solution comprising ceramics is cast on side (A) of the sheet, then dried to
remove solvent from the solution and prepare a green sheet, (B) is peeled off
to prepare a green sheet comprising (A) as base support. The green sheet
is fabricated, then (A) is peeled off to prepare a ceramic sheet or a
shaped ceramic article.

USE/ADVANTAGE - A thin ceramic sheet and/or shaped ceramic article
can be prepared readily by using the laminated sheet. Besides ceramics, the
sheet can be used for releasing sheet for casting a rubber or a polymer
from the solution. - In an example, polyphenylenesulphide (A) comprising 0.2
weight% of dispersed silica and polyethyleneterephthalate (B) was extruded
separately and melt laminated through a die into a two layer laminated
sheet. The sheet was drawn biaxially and heat set at 240 deg.C.
to prepare a sheet having a thickness of (a) (30 and (b) 70 microns, (p/a)
was 4.7 and adhesivity between (A) and (B) 95 g/cm. Alumina fine powder
slurry dispersed in methanol-butylbenzoylphenol was applied to (A) surface
of the sheet and dried at 100 deg.C.. The (B) layer was peeled from (A).
The obtd. green sheet was through holed and printed with an
electroconductive paste and dried at 150 deg.C.. The ceramic sheet was
peeled from (B) and calcinated at 800 deg.C. to prepare a ceramic printed
circuit having uniform thickness and no cracks.

L18 ANSWER 16 OF 23 WPIX COPYRIGHT 2009 THOMSON REUTERS on STN

AN 1989-238133 [33] WPIX

DNC C1989-106348 [21]

DNN N1989-181221 [21]

TI Electric insulation film having good mechanical strength - comprises polymer film with plasma polymerised layer of organo silicone on both sides

DC A28; A85; L03; V06; X12; X27

IN HATADA K; YOKURA M

PA (TORA-C) TORAY IND INC

CYC 1

PIA JP 01173513 A 19890710 (198933)* JA 4[0]

ADT JP 01173513 A JP 1987-331681 19871226

PRAI JP 1987-331681 19871226

AB JP 01173513 A UPAB: 20050428

Film consists of a polymer film, and a plasma polymerisation layer composed of organic silicone applied to both sides of the polymer film:

The polymer film, e.g. consists of polyphenylene-sulphide, polyimide or pref. polyester. the polyester film is pref. biaxially stretched polyester film composed of polyethylene-terephthalate, polyethylene isophthalate or polybutylene terephthalate, and may contain blended polymer such as polyalkylene glycol or polycarbonate, and inorganic particles composed of Ca carbonate, silica, kaolin or Ti oxide. The plasma polymerised layer can be produced by electric discharge in vapour of organic silicone having siloxane bond.

USE/ADVANTAGE - The film has excellent mechanical strength, transparency, electric insulation property, and resistance to elution of oligomer, and is suitable as electric insulation material for compressor motors used in refrigerators or air conditioners.

L6 ANSWER 10 OF 10 WPIX COPYRIGHT 2009 THOMSON REUTERS on STN
AN 1979-59055B [32] WPIX
TI FET reference electrode production - involves coating gate part of
IGFET with hydrophobic organic high polymer
DC A85; J04; L03; S03; U12
IN MAKIMOTO T; SHIBATANI K; SHIMADA K; YANO M
PA (KURS-C) KURARAY CO LTD
CYC 3
PIA JP 54081897 A 19790629 (197932)* JA
GB 2017400 A 19791003 (197940) EN
US 4269682 A 19810526 (198124) EN
GB 2017400 B 19820506 (198218) EN
JP 58025221 B 19830526 (198325) JA
ADT JP 54081897 A JP 1977-150093 19771212
PRAI JP 1977-150093 19771212
AB JP 54081897 A UPAB: 20060102

FET reference electrode is obtd. by coating a hydrophobic organic high polymer film n at least the gate part surface of a gate insulating type electric field effect transistor.

By using the FET reference electrode, the size of a complex electrode consisting of a sensor using an FET and a reference electrode can be made small and stable determination is possible.

The polymer is pref. a polyolefin (polyethylene), a halogenated polyolefin (PVC) synthetic rubber (polyisoprene), polyamide, etc. especially PVC. The gate part surface having ion-sensitive layer, silicon oxide or silicon nitride is coated by such a hydrophobic high polymer film. The FET reference electrode is small and is used together with a quasi-electrode.

L18 ANSWER 2 OF 23 HCAPLUS COPYRIGHT 2009 ACS on STN

AN 2002:113022 HCAPLUS

DN 136:168597

TI Gas-barrier laminated films having metal oxide and inorganic-
organic hybrid polymer layers

IN Yoshihara, Toshio; Oguchi, Kiyoshi

PA Dai Nippon Printing Co., Ltd., Japan

SO Jpn. Kokai Tokkyo Koho, 13 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2002046209	A	20020212	JP 2000-234266	20000802
PRAI	JP 2000-234266		20000802		

AB The films comprise substrates successively laminated with (A) a 100-5000-Å SiO₂ and/or Si carbide oxide preferably at the Si/O ratio 1/1.2-1.8 or surface free energy 70-95 with sp. surface area 0.2-2.0 m²/g and average pore size 0.7-2.0 nm obtained by PVD and/or low-temperature plasma-assisted CVD and (B) inorg.-organic hybrid polymer (ORMOCER) layers. Thus, deposition of a 550-Å Si oxide PVD layer (sp. surface area 1.69 m²/g; average pore size 1.53 nm) on NSC (biaxially stretched PET film) followed by application of a ORMOCER composition containing γ-glycidoxypropyltrimethoxysilane 94, γ-aminopropyltrimethoxysilane 11, propyltrimethoxysilane 57.5, and Al(sec-Bu)₃ 49 g and curing at 130° for 2 h to give a gas-barrier film with O and moisture permeability 0.5 mL/m²/day and 0.6 g/m²/day, resp.

TI Gas-barrier laminated films having metal oxide and inorganic-
organic hybrid polymer layers

AB . . . deposition of a 550-Å Si oxide PVD layer (sp. surface area 1.69 m²/g; average pore size 1.53 nm) on NSC (biaxially stretched PET film) followed by application of a ORMOCER composition containing γ-glycidoxypropyltrimethoxysilane 94, γ-aminopropyltrimethoxysilane 11, propyltrimethoxysilane 57.5, and Al(sec-Bu)₃ 49 g. . .

IT Ceramers

Laminated plastic films

(gas-barrier laminated films having metal oxide and inorg.-organic hybrid polymer layers)

L18 ANSWER 14 OF 23 WPIX COPYRIGHT 2009 THOMSON REUTERS on STN
AN 1993-313101 [40] WPIX
DNC C1993-139100 [40]
TI Release film for improved adhesion - comprises polymeric pref.
polyester substrate, layer containing organic
polyurethane polymer with reactive and polysiloxane segments, and silicone
release layer
DC A17; A28; A82; G02; P42; P73
IN PANKRATZ R P
PA (DUPO-C) DU PONT DE NEMOURS & CO E I
CYC 6
PIA EP 563704 A1 19931006 (199340)* EN 9[0]
CA 2091083 A 19931001 (199351) EN
JP 06039970 A 19940215 (199411) JA 7[0]
US 5415935 A 19950516 (199525) EN 5[0]
JP 2512858 B2 19960703 (199631) JA 7[0]
EP 563704 B1 19961002 (199644) EN 10[0]
DE 69305101 E 19961107 (199650) DE
ADT EP 563704 A1 EP 1993-104542 19930319; US 5415935 A US 1992-860838
19920331; CA 2091083 A CA 1993-2091083 19930305; DE 69305101 E DE
1993-69305101 19930319; EP 563704 B1 EP 1993-104542 19930319; DE 69305101
E EP 1993-104542 19930319; JP 06039970 A JP 1993-71386 19930330; JP
2512858 B2 JP 1993-71386 19930330
FDT DE 69305101 E Based on EP 563704 A; JP 2512858 B2 Previous Publ JP
06039970 A
PRAI US 1992-860838 19920331
AB EP 563704 A1 UPAB: 20060108
The film (I) comprises A) a polymeric film
substrate (II); B) a layer (III) containing an organic polymer (IV)
with reactive segments (IVa) and polysiloxane segments (IVb), and C) a
silicone release layer (V).
Pref. the preparation comprises providing (II), applying (IV) and drying the
material to form a layer. A silicone release material is applied and dried
to form (V). (II) is a polyester, polyamide, polyimide, or polyolefin
(especially a uniaxially or biaxially stretched polyester,
especially PET). (III) is a thermally hardened layer comprising the reaction
prod. of (IV) a crosslinking agent (VI) and a catalyst (VII). (IVa)
contains carboxyl, hydroxyl, amino, amide or oxirane gps. or is a
polycarbonate.
(IV) is a polyurethane polymer which is the reaction prod. of an organic
polyisocyanate, a polycarbonate polyol and an isocyanate reactive
polydialkyl siloxane. (V) comprises an organo polysiloxane. (VI) is of
melamine-, urea-, benzoguanamine- or glycoluril-formaldehyde resin, epoxy
and aziridine resin.
ADVANTAGE - Improved adhesion between (II), the primer layer (III)
and (V) is obtd.

L6 ANSWER 7 OF 10 WPIX COPYRIGHT 2009 THOMSON REUTERS on STN

AN 1988-202318 [29] WPIX

DNC C1988-090450 [21]

DNN N1988-154326 [21]

TI Metal oxide semiconductor field effect transistor - can control surface potential of semiconductor using charge transfer phenomenon of organic thin film present

DC L03; U11; U12

IN MIZUSHIMA K; MOTOMA N

PA (TOKE-C) TOSHIBA KK

CYC 1

PIA JP 63140576 A 19880613 (198829)* JA 11[8]

ADT JP 63140576 A JP 1986-285940 19861202

PRAI JP 1986-285940 19861202

AB JP 63140576 A UPAB: 20050428

Field effect transistor (FET) has an organic thin film containing donor molecule or acceptor molecule between a gate electrode and a semiconductor substrate.

USE/ADVANTAGE - Control of the surface potential of the semiconductor can be effected utilising charge transfer phenomenon of the organic thin film. - In an example, MOSFET has p type Si substrate, source and, drain electrodes, an oxide layer on the gate section of the substrate, an insulating layer, a donor molecule film and a gate electrode. The oxide layer was produced by oxidation heat treatment. The insulating layer and the donor molecule film were produced by the Langmuir-Blodgett technique. The organic thin film contains polymer of acrylate, vinylether, styrene, vinylalcohol or acrylamide, or polyamide etc. as matrix material.

L6 ANSWER 2 OF 10 HCAPLUS COPYRIGHT 2009 ACS on STN

AN 2001:208792 HCAPLUS

DN 134:334942

TI Gate-induced superconductivity in a solution-processed organic polymer film

AU Schon, J. H.; Dobabalapur, A.; Bao, Z.; Kloc, Ch.; Schenaker, O.; Batlogg, B.

CS Bell Laboratories, Lucent Technologies, Murray Hill, NJ, 07974, USA

SO Nature (London, United Kingdom) (2001), 410(6825), 189-192

CODEN: NATUAS; ISSN: 0028-0836

PB Nature Publishing Group

DT Journal

LA English

AB We report a distinct metal-insulator transition and metallic levels of conductivity in a polymer field-effect transistor. The active material is solution-cast regioregular poly(3-hexylthiophene), which forms relatively well ordered films owing to self-organization, and which yields a high charge carrier mobility ($0.05\text{--}0.1\text{ cm}^2\text{V}^{-1}$) at room temperature. At $\sim 2.35\text{ K}$ with sheet carrier densities exceeding $2.5 \times 10^{14}\text{ cm}^{-2}$, the polythiophene film becomes superconducting. The appearance of supercond. seems to be closely related to the self-assembly properties of the polymer, as the introduction of addnl. disorder is found to suppress supercond. Our findings therefore demonstrate the feasibility of turning the elec. properties of conjugated polymers over the largest range possible—from insulating to superconducting.

13/5,K/2 (Item 2 from file: 2)
DIALOG(R)File 2: INSPEC
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07955439

Title: Gate-induced superconductivity in a solution-processed organic polymer film

Author(s): Schon, J.H.; Dodabalapur, A.; Bao, Z.; Kloc, Ch.; Schenker, O.; Batlogg, B.

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Country of Publication: UK

Publication Date: 8 March 2001

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CODEN: NATUAS

U.S. Copyright Clearance Center Code: 0028-0836/2001/\$12.00+2.00

Language: English

Document Type: Journal Paper (JP)

Treatment: Experimental (X)

Abstract: The electrical and optical properties of conjugated polymers have received considerable attention in the context of potentially low-cost replacements for conventional metals and inorganic semiconductors. Charge transport in these organic materials has been characterized in both the doped-metallic and the semiconducting state, but superconductivity has not hitherto been observed in these polymers. Here we report a distinct metal-insulator transition and metallic levels of conductivity in a polymer field-effect **transistor**. The active material is solution-cast regioregular poly(3-hexylthiophene), which forms relatively **well ordered** films owing to self-organization, and which yields a high charge carrier mobility ($0.05\text{--}0.1\text{ cm}^2\text{ V}^{-1}\text{ s}^{-1}$) at room temperature. At temperatures below $\sim 2.35\text{ K}$ with sheet carrier densities exceeding $2.5 \times 10^{14}\text{ cm}^{-2}$, the polythiophene film becomes superconducting. The appearance of superconductivity seems to be closely related to the self-assembly properties of the polymer, as the introduction of additional disorder is found to suppress superconductivity. Our findings therefore demonstrate the feasibility of tuning the electrical properties of conjugated polymers over the largest range possible—from insulating to superconducting (*31 refs.*)

Subfile(s): A (Physics)

Descriptors: conducting polymers; field effect **transistors**; metal-insulator transition; **organic** superconductors; **polymer films**; self-assembly; superconducting thin films; superconducting transitions

Identifiers: gate-induced superconductivity; solution-processed **organic polymer film**; optical properties; electrical properties; conjugated polymers; charge transport; metal-insulator transition; metallic conductivity; polymer field-effect **transistor**; active material; solution-cast regioregular poly(3-hexylthiophene); relatively **well ordered** films; self-organization; high charge carrier mobility; room temperature; sheet carrier densities; polythiophene film; self-assembly; additional disorder

Classification Codes: A7475 (Superconducting films); A7130 (Metal-insulator transitions and other electronic transitions); A7470K (Organic superconductors); A7465 (Insulator-superconductor transition); A7410 (Superconducting critical temperature, occurrence)

INSPEC Update Issue: 2001-024

Copyright: 2001, IEE

L18 ANSWER 8 OF 23 WPIX COPYRIGHT 2009 THOMSON REUTERS on STN

AN 1997-332028 [30] WPIX

DNC C1997-106508 [30]

DNN N1997-275634 [30]

TI Polymer substrate has organic polymer coating applied over primer - comprising polyfunctional acryloyl monomer and colloidal silica

DC A18; A23; A82; A85; A89; G02; G03; G06; L03; P73

IN BILKADI Z

PA (MINN-C) MINNESOTA MINING & MFG CO

CYC 1

PIA US 5639546 A 19970617 (199730)* EN 9[0]

ADT US 5639546 A US 1991-754458 19910903

PRAI US 1991-754458 19910903

AB US 5639546 A UPAB: 20060113

A polymer substrate has a primer layer and over the primer layer an organic polymer coating. The primer comprises the cured product composition of 15 weight% polymerisable acryloyl materials, including 5 weight% polyfunctional acryloyl monomer (I), and 5-80 weight% colloidal silica particles individually dispersed in the composition. The composition contains less than 10 weight% of any silicone materials.

USE - The coated product can be an abrasive product in which the topcoat has a thermosetting binder containing abrasive particles or a pressure sensitive adhesive tape or magnetic tape, or the top coat can be a photosensitive imaging layer. The primer bonds well to various top coats.

TI Polymer substrate has organic polymer coating applied over primer - comprising polyfunctional acryloyl monomer and colloidal silica

TT TT: POLYMER SUBSTRATE ORGANIC COATING APPLY PRIME
COMPRISE POLYFUNCTIONAL ACRYLYL MONOMER COLLOID SILICA

ALE A polymer substrate has a primer layer and over the primer layer an organic polymer coating. The primer comprises the cured product composition of 15 wt.% polymerisable acryloyl materials, including 5 wt.% polyfunctional acryloyl. . . .

ABDT US5639546

A polymer substrate has a primer layer and over the primer layer an organic polymer coating. The primer comprises the cured product composition of 15 wt.% polymerisable acryloyl materials, including 5 wt.% polyfunctional acryloyl.. . . wt.% silica sol comprising 15nm particles dispersed in isopropanol and 4 wt.% photoinitiator. The resulting primer was applied to a biaxially oriented polyethylene terephthalate film which had been exposed to a corona discharge in nitrogen. The film was overcoated with a 75%.. . .

13/5,K/4 (Item 1 from file: 8)

DIALOG(R)File 8: Ei Compendex(R)

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0014433003 E.I. COMPENDEX No: 1999494859334

Charge carrier mobilities in mesomorphic alpha,omega-dihexylquaterthiophene: a comparative microwave conductivity and thin film transistor study

Wegewijs, B.; de Haas, M.P.; de Leeuw, D.M.; Wilson, R.; Sirringhaus, H.

Corresp. Author/Affil: Wegewijs, B.: Delft Univ of Technology, Delft, Netherlands

Conference Title: Proceedings of the 1998 International Conference on Science and Technology of Synthetic Metals (ICSM-98)

Conference Location: Montpellier **Conference Date:** 19980712-19980718

Sponsor: Ministere de l'Education Nationale; Universite de Montpellier II; Conseil Regional du Languedoc-Roussillon; District de Montpellier

E.I. Conference No.: 55266

Synthetic Metals (Synth Met) 1999 101/1 ([d]534-535)

Publication Date: 19990101

Publisher: Elsevier Sequoia SA

CODEN: SYMED **ISSN:** 0379-6779

Item Identifier (DOI): [10.1016/S0379-6779\(98\)00559-1](https://doi.org/10.1016/S0379-6779(98)00559-1)

Document Type: Article; Journal **Record Type:** Abstract

Treatment: X; (Experimental)

Language: English **Summary Language:** English

Number of References: 4

The charge carrier mobility in alpha,omega-dihexylquaterthiophene has been determined as a function of temperature using the Pulse-Radiolysis Time-Resolved Microwave Conductivity (PR-TRMC) and **Thin Film Transistor (TFT)** techniques. At room temperature a minimum value of 0.015 cm SUP 2/Vs was obtained with PR-TRMC for the amorphous powder, close to the mobility obtained in **TFT** experiments on a **well-ordered** film. The PR-TRMC mobility decreases by 30% at 81(deg)C and drops to less than 10 SUP -4 cm SUP 2/Vs above 180(deg)C. These temperatures correspond to two reversible phase transitions discernable in DSC scans. With **TFT** experiments only the first phase transition could be studied, showing a decrease in mobility very similar to that observed in the PR-TRMC study.

Descriptors: Carrier mobility; Charge carriers; Electric conductivity; Liquid crystal polymers; Phase transitions; Photochemical reactions; Synthesis (chemical); Temperature; **Thin film transistors**; ***Organic polymers**

Identifiers: Mesomorphic dihexylquaterthiophene; Pulse radiolysis time resolved microwave conductivity

Classification Codes:

815.1.1 (Organic Polymers)

701.1 (Electricity, Basic Concepts & Phenomena)

714.2 (Semiconductor Devices & Integrated Circuits)

801.4 (Physical Chemistry)

802.3 (Chemical Operations)

931.3 (Atomic & Molecular Physics)

21/5,K/3 (Item 1 from file: 8)

DIALOG(R)File 8: Ei Compendex(R)

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0014678982 **E.I. COMPENDEX No:** 2000515395603

Oxygen barrier coatings based on supramolecular assembly of melamine

Jahromi, Shahab; Moosheimer, Ulrich

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Author email: shahab.jahromi@dsm-group.com

Macromolecules (Macromolecules) 2000 33/20 (7582-7587)

Publication Date: 20001003

Publisher: ACS

CODEN: MAMOB **ISSN:** 0024-9297

Item Identifier (DOI): [10.1021/ma0007536](https://doi.org/10.1021/ma0007536)

Document Type: Article; Journal **Record Type:** Abstract

Treatment: X; (Experimental)

Language: English **Summary Language:** English

Number of References: 18

Gas permeability is one of the key performance characteristics of polymeric films. Here we explore a novel approach for modifying the oxygen transmission rate of polymers by vapor deposition of melamine. We will show that melamine, upon physical vapor deposition, forms a transparent uniform layer on **polymeric films** such as **biaxially oriented** polypropylene. X-ray diffraction, in combination with molecular modeling, has indicated that the melamine coating is crystalline and macroscopically oriented with the preferred direction of the melamine molecules parallel to the (polymeric) substrate. The vapor-deposited melamine molecules undergo a large number of cooperative hydrogen bond interactions leading to a coherent layer of an infinite supramolecular network. The melamine coating acts as a surprisingly effective barrier against gases, decreasing drastically, for example, the oxygen transmission rate through coated polymer films by 2 orders of magnitude. The effect is attributed to the crystalline nature of the deposited melamine layer, strengthened by the high level of hydrogen bonding. This is the first example of application of supramolecular chemistry for the production of health and environment friendly transparent barrier coatings against oxygen. The vacuum-coating process with melamine and related compounds is expected to bring a major breakthrough in the field of transparent polymeric barrier films for applications, for example, in food and pharmaceutical packaging.

Descriptors: Composition effects; Crystal orientation; Hydrogen bonds; Melamine; Molecular dynamics; Molecular structure; **Organic coatings**; Transparency; Vapor deposition; *Plastic films

Identifiers: Oxygen barrier coatings; Physical vapor deposition (PVD)

Classification Codes:

801.4 (Physical Chemistry)

804.1 (Organic Compounds)

813.2 (Coating Materials)

817.1 (Plastics Products)

931.3 (Atomic & Molecular Physics)

801 (Chemistry)

21/5,K/5 (Item 1 from file: 34)

DIALOG(R)File 34: SciSearch(R) Cited Ref Sci

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01233573 **Genuine Article#:** GG466 **Number of References:** 25

Title: DIRECT MEASUREMENT OF MOLECULAR-LEVEL ADHESION FORCES BETWEEN
BIAXIALLY ORIENTED SOLID POLYMER-FILMS

Author: MERRILL WW; POCIUS AV; THAKKER BV; TIRRELL M

Corporate Source: THREE M CO,3M CTR,BLDG 236-GA-03/ST PAUL//MN/55144; THREE M CO,3M
CTR,BLDG 236-GA-03/ST PAUL//MN/55144; UNIV MINNESOTA,DEPT CHEM ENGN & MAT
SCI/MINNEAPOLIS//MN/55455

Journal: LANGMUIR , 1991 , V 7 , N9 , P 1975-1980

Language: ENGLISH **Document Type:** ARTICLE

Geographic Location: USA

Subfile: SciSearch; CC PHYS--Current Contents, Physical, Chemical & Earth Sciences

Journal Subject Category: CHEMISTRY, PHYSICAL

Abstract: We report the first measurements of the solid surface energy of a polymer film by means of the Israelachvili surface forces apparatus (SFA). To this end, poly(ethylene terephthalate) (PET) films were generated in 3.5-6- μ m thick samples, which could be silvered and used in the SFA. Adhesive contact pull-off forces were measured in air for unmodified PET as well as for PET modified by direct fluorination. The solid surface energy of the polymer films was determined by application of the Johnson-Kendall-Roberts (JKR) theory or the Derjaguin-Muller-Toporov (DMT) theory. Measurements of the critical wetting tension as well as surface analysis by XPS were done on the PET surfaces. The value of solid surface energy for untreated PET predicted by the DMT theory agrees well with the critical wetting tension determined by contact angle measurements, but the details of the shape of the contacting interface as well as the radius at pull-off are best represented by the JKR theory. With increasing fluorination of the PET surface, the wettability by polar liquids increases while the SFA solid surface energy decreases. This is ascribed to a weak boundary layer generated by the fluorination.

Descriptors: SCI

Identifiers: KeyWords Plus: CONTACT DEFORMATIONS; MECHANICS; SURFACES; MICA

Research Fronts: 89-0753 001 (INTERACTING MEMBRANES; LIPID BILAYERS; HYDRATION FORCES;
LECITHIN-WATER SYSTEM; CETYLTRIMETHYLAMMONIUM BROMIDE)

89-6722 001 (ADHESION-INDUCED DEFORMATIONS; PARTICLES IN BINARY ORGANIC MEDIA;
COHESIVE FORCES AFFECTING POWDER FLUIDIZATION)

89-6733 001 (SURFACE HYDROPHOBICITY; WETTABILITY OF SUBSTRATE MATERIALS; PLASMA
MODIFIED POLYMERS; MONOLAYER FILMS; CONTACT ANGLES; ORGANIC THIOLS)

26/5,K/1 (Item 1 from file: 34)

DIALOG(R)File 34: SciSearch(R) Cited Ref Sci

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04688805 **Genuine Article#:** UB458 **Number of References:** 30

Title: POLYPYRROLE-POLYPROPYLENE COMPOSITE FILMS - PREPARATION AND PROPERTIES

Author: YANG JP; YANG YJ; HOU JA; ZHANG X; ZHU W; XU M; WAN MX

Corporate Source: ACAD SINICA,INST CHEM,POLYMER PHYS LAB/BEIJING 100080//PEOPLES R CHINA/;
ACAD SINICA,INST CHEM,POLYMER PHYS LAB/BEIJING 100080//PEOPLES R CHINA/; ACAD
SINICA,INST CHEM,ORGAN SOLID LAB/BEIJING 100080//PEOPLES R CHINA/

Journal: POLYMER , 1996 , V 37 , N5 (MAR) , P 793-798

ISSN: 0032-3861

Language: ENGLISH **Document Type:** ARTICLE

Geographic Location: PEOPLES REPUBLIC OF CHINA

Subfile: SciSearch; CC PHYS--Current Contents, Physical, Chemical & Earth Sciences

Journal Subject Category: POLYMER SCIENCE

Abstract: Polypyrrole-polypropylene conducting polymer composite films with good mechanical properties and high electrical conductivity were prepared using a two-direction permeation/diffusion polymerization method. The oxidant used was iron(III) chloride. Polypropylene microporous films prepared by the biaxial stretching technique were used as the matrix material. The maximum conductivity of these composite films, 6.0 S cm⁻¹, is of the same order of magnitude as that of pure polypyrrole, 4.5 S cm⁻¹, which was synthesized by chemical oxidation of pyrrole monomer in aqueous solution. The composite films exhibit quite uniform mechanical properties in the film plane. Youngs modulus is in the range 0.4-0.8 GPa, tensile strength 40-85 MPa and elongation at break 90-200%, maintaining the mechanical properties of polypropylene in the composite. Polymerization conditions, including reaction time, reaction temperature and concentrations of the pyrrole and FeCl₃ solutions, have a great influence on the structure and properties of the composite films. The structure of the conducting polymer in the composite films was characterized by X-ray photoelectron spectroscopy and the surface morphology of the films was investigated using scanning electron microscopy. Two kinds of surface structure were observed, one is a loose particle structure and the other is a compacted surface structure.

Descriptors: SCIAuthor Keywords: CONDUCTING POLYMER ; POLYPYRROLE ; POLYPROPYLENE

Identifiers: KeyWords Plus: ELECTROCHEMICAL POLYMERIZATION; POLYMERS; PYRROLE;
CHLORIDE); COMPLEXES

Research Fronts: 94-0169 003 (POLYMER LIGHT-EMITTING-DIODES; EFFICIENT BLUE
ELECTROLUMINESCENCE; AROMATIC DIAMINE; ORGANIC MATERIALS; PHOTOLUMINESCENCE OF
POLY(P-PHENYLENEVINYLENE))

94-3998 001 (CONDUCTING POLYMERS; POLY(3-METHYLTHIOPHENE) FILMS; ORGANIC
MATERIALS; ELECTRONIC MOBILITY; CONJUGATED SYSTEM; DIRECT ELECTRODEPOSITION)

30/5,K/6 (Item 1 from file: 6)

DIALOG(R)File 6: NTIS

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1268301 **NTIS Accession Number:** AD-A172 096/0

Surface Functionalized Polyethylene Film

(Final rept. Dec 82-Jan 86)

Whitesides, G. M.

Harvard Univ., Cambridge, MA. Dept. of Chemistry.

Corporate Source Codes: 004185095; 163730

Jun 86 9p

Language: English

Journal Announcement: GRAI8701

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NTIS Prices: PC A02/MF A01

Country of Publication: United States

Contract Number: N00014-83-K-0142

This project has: 1) Developed practical methods for oxidizing the surface of low-density polyethylene film and introducing reactive organic functionality into this oxidized surface layer. 2) Explored new techniques for analyzing the surfaces of organic polymeric solids. Contact angle titration--the study of the contact angle of water on organic solids as a function of pH--has proved particularly useful and extremely surface sensitive. 3) Characterized a series of new phenomena occurring in thin **organic surface layers**, including thermal reconstruction of the surface (a process during which functional groups in the surface migrate into the deeper parts of the polymer). 4) Examined the basic physical organic chemistry of wetting of organic solids. and 5) Applied the information from these studies to the synthesis of new interface-modifying agents, especially for adhesion promotion.

Descriptors: *Polymeric films; *Oxidation; *Polyethylene; Adhesion; Surfaces; Organic materials; Polymers; Solids; Water; Organic chemistry; Physical chemistry; Films; Low density; Parts; Synthesis; Wetting; Titration; Ph factor

Identifiers: NTISDODXA